International Journal of Public Policy and Administration Research
2025 Vol. 12, No. 4, pp. 304-321
ISSN(e): 2312-6515
ISSN(p): 2313-0423
DOI: 10.18488/74.v12i4.4584

Digitalisation of public services in Makassar City: Impacts on decision-making effectiveness and efficiency

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Article History
Received: 9 July 2025
Revised: 27 October 2025
Accepted: 8 December 2025
Published: 19 December 2025

Keywords
Decision-making
Digital governance
Digitalisation of public services
Efficiency
Effectiveness
Sustainable public services.

ABSTRACT

Digitalisation of public services has the potential to enhance the effectiveness and efficiency of decision-making processes. The present study employs an explanatory sequential design to assess the aforementioned effects in Makassar City, utilising a survey of 300 government employees and in-depth interviews with 10 key informants. The findings of this study indicate that digitalisation exerts a positive influence on the quality of decision-making processes (β=0.68, $p<0.01$). Furthermore, the results suggest that enhanced information transparency (β=0.55, $p<0.05$) and employee participation (β=0.62, $p<0.05$) serve to further bolster evidence-based decision-making practices. The model accounts for 86.4% of the variance in decision efficiency and effectiveness (R^2=0.864) through enhanced decision quality, with a substantial indirect effect of digitalization (β=0.72, $p<0.01$). Descriptively, the average decision processing time decreased from approximately five to seven days to one to two days, and 62% of respondents reported greater transparency regarding access to information following digitalisation. The persistent challenges confronting the region include digital literacy gaps, uneven infrastructure, and bureaucratic resistance. The study recommends a number of measures to ensure the continued provision of digital governance in Makassar City that is both inclusive and data-driven. These include ongoing digital literacy training, infrastructure upgrades, policy harmonisation, and strengthened cybersecurity.

Contribution/Originality: This study develops and tests an integrative model linking digitalization, information transparency, and employee participation to decision quality and, in turn, to decision efficiency. Using mixed methods and path analysis in Makassar City, it provides rare evidence from a developing country and offers practice-ready guidance for sustainable, data-driven public service reform and governance improvements.

1. INTRODUCTION

Digitalisation has become a pivotal catalyst for the transformation of public services, enhancing their efficiency and quality (Andersson, Hallin, & Ivory, 2022; Di Giulio & Vecchi, 2021; Escobar, Almeida, & Varajão, 2023; Lindgren & Van Veenstra, 2018; Syed, Bandara, & Eden, 2023). In the domain of public administration, the integration of digital technologies has been demonstrated to enhance transparency, accountability, and community participation (Danielsen, Flak, & Sæbø, 2022; Wanjiru, 2022). Makassar, a prominent economic centre in Eastern Indonesia, is

confronted with the challenge of implementing digital public services that are increasingly intricate in nature. The Indonesian State Civil Apparatus (ASN) plays a strategic role in delivering services that are both responsive and inclusive, which are technology-based (Madjid, 2024; Rojikinnor, 2020; Salam, 2021; Sary, Sukmariningsih, Mulyani, & Noor, 2024). However, legacies of convoluted bureaucracy, low accountability, and limited technological adaptation continue to constrain the optimization of digital initiatives (De Jong, 2016; Ikwuanusi, Onunka, Owoade, & Uzoka, 2024; Kulal, Rahiman, Suvarna, Abhishek, & Dinesh, 2024).

The terms "digitisation" and "digitalisation" are used to denote different processes. The former is defined as the conversion of analogue data into digital formats, whereas the latter is described as the broader socio-technical transformation of processes and organisations (Govers & Van Amelsvoort, 2023). Comparative experiences, such as the expansion of online services in digitally advanced administrations, demonstrate how digital platforms can reduce redundancy and improve efficiency (Utama, 2020). In Indonesia, the advancement of digitalisation has been facilitated by e-government systems and online licensing; yet, the efficacy of these measures is contingent on the capacity of civil servants to adopt and utilise technology effectively (Maxwell, Taner, & Jonathan, 2019; Qvarfordt & Lagrosen, 2024; Taufik, 2023; Tomaževič et al., 2023; Yuniarti, Hadmar, Zaenuri, & Mutiarin, 2024).

In Makassar City, the efforts to effect transformation are constrained by factors relating to human resource capacity, digital infrastructure, and regulatory coherence. As Taufik (2023) contends, the circumscribed scope of training and the heterogeneity in digital competence among civil servants hinder the effective implementation of digital technologies. It is evident that infrastructural disparities and deficiencies in digital literacy further impede equitable access to technology-based services (De Jong, 2016; Wawo & Majid, 2021), thereby reinforcing existing divides that can potentially diminish the efficacy of programs (Breit, Egeland, Løberg, & Røhnebæk, 2021).

A comprehensive review of the extant literature reveals substantial benefits of digitalisation while also highlighting the enabling conditions required for successful implementation. The degree of success is contingent upon civil-service capabilities, the extent of stakeholder participation, and the presence of policies that support digital governance (Aristovnik, Ravšelj, & Murko, 2024; Bilan, Mishchuk, & Samoliuk, 2023; Di Giulio & Vecchi, 2021; Rojikinnor, 2020; Salam, 2021). In accordance with these findings, Saruji and Hamid (2021), Milakovich (2021), and Newman, Mintrom, and O'Neill (2022) have reported improvements in administrative transparency and the acceleration of data-driven decision-making on a global scale. However, the available evidence pertaining to Makassar remains limited. As demonstrated in previous studies (Breit et al., 2021), transparency, accountability, and service quality have been the focus of extensive research. Nevertheless, significant gaps remain in our understanding. As demonstrated in the works of Gersonskaya (2020); Rainero and Modarelli (2021); Prayitno (2023) and Valackiene and Giedraitiene (2024): the following issues have been identified: firstly, a paucity of empirical tests directly linking digitalisation, information transparency, and the participation of the Indonesian State Civil Apparatus (Aparatur Sipil Negara, ASN) to improved decision-making; secondly, an insufficiency of comprehensive evaluations of digital systems to determine their effectiveness in enhancing service efficiency; and thirdly, the absence of an integrative model that combines infrastructure readiness, ASN digital literacy, and supportive policies.

In this context, Makassar City requires empirical evidence on how digitalisation affects the efficiency and effectiveness of decision-making processes in public administration and the mechanisms through which these effects occur. This study, therefore, examines the impact of digitalisation on the efficiency of decision-making processes, focusing on the mediating roles of information transparency and employee participation. The objective of this initiative is twofold: firstly, to formulate a data-driven strategy that will enhance the efficacy of digital governance in Makassar; and secondly, to achieve this objective.

2. LITERATURE REVIEW

Digitalisation has had a profound impact on governance structures, particularly in the domain of public service delivery. The utilisation of digital tools to enhance bureaucratic procedures, improve service quality, and promote

transparency is a central tenet of this approach (Andersson et al., 2022; Escobar et al., 2023; Lindgren & Van Veenstra, 2018). In the context of developing countries, digitalization is regarded as a means of reducing inefficiencies and enhancing responsiveness (Di Giulio & Vecchi, 2021; Syed et al., 2023).

2.1. Digitalisation and Decision-Making Quality

Digital platforms facilitate data-driven decision-making by enabling real-time information access and enhancing administrative coordination. Evidence from Indonesia and South Korea demonstrates that digitalization accelerates public decisions by automating documentation and reducing redundancy (Saruji & Hamid, 2021; Utama, 2020). In the context of this study, it is hypothesized that digitalisation will positively impact the quality of decision-making in public service administration (H_1).

2.2. Transparency in Digital Governance

Transparency is a pivotal outcome of digital public services. Digital platforms facilitate open access to public data, thereby enabling traceability of decisions and reducing information asymmetry (Androniceanu, 2021; Pekkarinen, Hasu, Melkas, & Saari, 2021). Empirical studies have confirmed that transparency improves accountability and decision legitimacy, especially during crises such as the ongoing pandemic (Agustino, Harsemadi, & Budaya, 2022; Kovač, Tadić, Krstić, & Bouraima, 2021). Consequently, transparency is hypothesized to positively influence the quality of decision-making (H_2).

2.3. Employee Participation in Digital Systems

Employee engagement has been identified as a critical factor in the success of digital systems. When public servants are involved in training and feedback processes, they develop a sense of ownership, which enhances system usability and innovation (Maxwell et al., 2019; Qvarfordt & Lagrosen, 2024). The present study aims to test the hypothesis that participation improves the quality of decision-making (H_3).

2.4. Decision-Making Quality and Administrative Efficiency

Decision-making quality is a direct antecedent to efficiency in governance. The accuracy and promptness of decisions have been demonstrated to minimize operational delays and enhance policy impact (Matitah, Arifin, Sumarto, & Widiyanto, 2021). This is of particular importance in service settings that require rapid, data-driven responses. It is hypothesized that an improvement in decision-making quality will result in greater efficiency and effectiveness (H_4).

2.5. Mediating Role of Decision-Making Quality

The existing body of research on mediation mechanisms in digital governance is limited, particularly in the context of local administrative systems. Research indicates that digitalisation can lead to enhanced outcomes through the optimisation of information flow and human-system interaction (Aristovnik et al., 2024; Bilan et al., 2023). The present study hypothesizes that the quality of decision-making exerts a mediating effect on the relationship between digitalization and the efficiency and effectiveness of decision-making (H_5).

2.6. Gaps in the Literature

Despite the proliferation of literature on digital transformation, empirical studies examining mediating variables such as transparency and employee participation in decision quality remain sparse, especially in Southeast Asia. It is imperative to develop a comprehensive model that can capture these intricate interrelations, thereby providing a foundation for the design of targeted policies. The present study makes a contribution to the existing body of knowledge by means of an empirical test of a multi-path model situated in Makassar City, Indonesia.

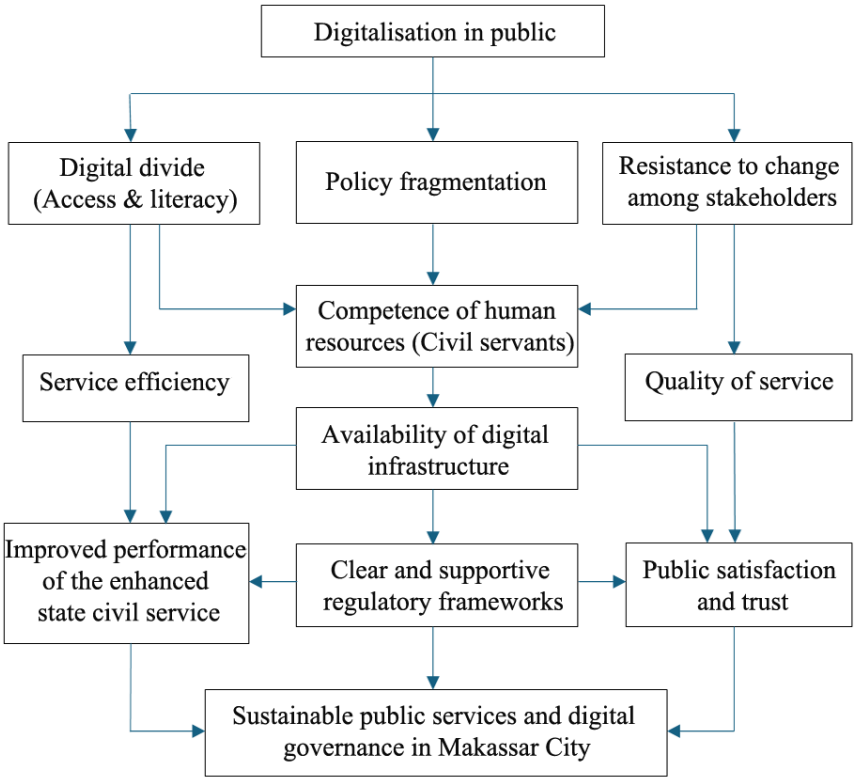

Figure 1. Conceptual framework of the role of digitalization in improving the efficiency and quality of public services in Makassar City.

Figure 1 presents the conceptual framework that underpins this study. It depicts digitalisation in public administration as the primary driver that reshapes three constraining conditions: the digital divide (access and literacy), policy fragmentation, and stakeholder resistance. These conditions interact with, and are mitigated by, three enabling capacities: civil-servant competence, the availability of digital infrastructure, and clear, supportive regulatory frameworks. Together, these capacities channel the effects of digitalisation toward two immediate outcomes: greater service efficiency and higher service quality, which elevate public satisfaction and trust and strengthen civil service performance. The framework culminates in sustainable public services and data-driven digital governance in Makassar City and informs our variable operationalisation, hypothesis specification, and explanatory sequential design. It also provides the logic for testing indirect pathways whereby digitalisation enhances evidence-based decision-making through improved information transparency and expanded employee participation.

3. RESEARCH METHODOLOGY

3.1. Study Design

This study was conducted in Makassar City, South Sulawesi, between March and October 2024, encompassing government agencies that facilitate digital public services in accordance with the city's smart city vision. An explanatory sequential design was adopted, with a quantitative survey providing the primary empirical evidence and qualitative work (interviews and documentation) used to contextualize mechanisms and triangulate the quantitative results.

3.2. Participants and Sampling

The target population comprised State Civil Apparatus (ASN) engaged in digital workflows. To ensure representation across major service units, stratified random sampling was implemented. The target sample size was set at 300 respondents, and the final analytic sample comprised 300 valid cases following data cleaning procedures.

The inclusion criteria required respondents to be active ASN with a minimum of six months' exposure to relevant digital processes; probationary staff and surveys with excessive missing responses were excluded from the study. In-depth interviews with ten key informants, including senior officials and technical staff, were conducted to complement the survey, aiming to capture implementation details and perceived barriers.

3.3. Measures: Questionnaire Structure and Coding

The questionnaire under review measured five latent constructs using multi-item Likert scales ranging from 1 (strongly disagree) to 5 (strongly agree). The digitalisation of public services encompasses a range of factors, including the availability and integration of e-services, interoperability across agencies, system stability, usage intensity (e.g., e-submission and e-tracking), and automation of verification. Information transparency is reflected in the openness and timeliness of data, as well as its accessibility to authorized users, the traceability of decisions, and the clarity of responsibilities. The extent to which employees participated was evaluated using the following criteria: engagement in training, provision of feedback, involvement in process improvement and cross-unit collaboration, and perceived empowerment.

The quality of decision-making encompasses several factors, including the utilization of evidence, the accuracy of the decisions made, the timeliness of these decisions, the clarity of the criteria employed, and the extent to which inter-agency coordination supports the decision-making process. The efficiency and effectiveness of the decision-making process were measured by a number of factors, including the reduction in turnaround time, the reduction in rework and errors, the cost consciousness of the decision-making process, the reliability of the outcomes, and stakeholder satisfaction.

The items were adapted from prior literature and refined through expert review to align with the Makassar context. When necessary, items were translated and back-translated by bilingual experts. A small pilot study with approximately thirty respondents confirmed clarity and timing, and feedback informed minor wording adjustments. Negatively worded items (if applicable) were reverse coded, and construct scores were computed as the mean of their items so that higher values indicate higher levels of each construct.

3.4. Data Collection Procedures and Ethics

The enumerators underwent training to standardise the administration process and ensure the confidentiality of the information collected. Participation in the study was voluntary, and informed consent was obtained from all subjects. To ensure the confidentiality of the subjects' responses, the responses were anonymised. Details pertaining to the ethical approval are to be found in the IRB Statement following the conclusion. In addition to the survey and interviews, documentation was reviewed (policy files, performance reports, and platform usage logs) in order to corroborate self-reports and provide institutional context for the findings.

3.5. Data Quality Control

Prior to the modeling stage, quality controls were implemented. Item nonresponse below five percent was addressed through item-level mean imputation, while cases with more than twenty percent missing data within a construct were listwise deleted. The identification of univariate outliers was accomplished through the utilization of standardised scores, whilst multivariate outliers were identified via Mahalanobis distance with a p-value less than 0.001. The skewness and kurtosis of the distribution were then inspected in order to assess the distributional assumptions. In order to mitigate and diagnose common method bias, procedural remedies (psychological separation and varied anchors) were combined with statistical checks, including a single factor test and full collinearity variance inflation factors. VIF values below five were considered acceptable.

3.6. Reliability and Validity Assessment

The internal consistency of the scale was evaluated using Cronbach's alpha and Composite Reliability, with a threshold of 0.70. The convergent validity of the model was assessed via Average Variance Extracted, with a threshold of 0.50. The discriminant validity of the model was examined using the Fornell–Larcker criterion and the heterotrait–monotrait ratio, with values below 0.85 being targeted. The validity assessment also encompassed the reporting of correlations among constructs and multicollinearity diagnostics.

3.7. Analytical Strategy

The estimation of a path model within a structural equation framework was conducted. The study hypothesized that the implementation of exogenous constructs, namely digitalization, information transparency, and employee participation, would result in enhanced decision-making quality. This, in turn, was predicted to lead to increased decision efficiency and effectiveness. The report contains standardized path coefficients (β), standard errors or t-values, p-values, 95% bootstrap confidence intervals based on a minimum of 5,000 resamples, and R^2 statistics. The indirect effects that quantify mediation were tested via bootstrapping and interpreted alongside direct effects to establish the mechanism linking digitalization to efficiency outcomes. All analyses were conducted in SmartPLS, using two-tailed tests with α=0.05.

3.8. Equation Specification

To enhance the clarity of the statistical model, the structural equations are presented explicitly. The variables tested in this study include X_1 (level of digitalisation of public services), X_2 (information transparency), X_3 (employee participation), Y (quality of decision-making), and Z (efficiency and effectiveness of decisions). The first structural equation defines decision-making quality (Y) as a function of the three exogenous constructs.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon_1 \quad (1)$$

The second structural equation specifies efficiency and effectiveness (Z) as a function of decision-making quality and the same three exogenous constructs.

$$Z = \gamma_0 + \gamma_1 Y + \gamma_2 X_1 + \gamma_3 X_2 + \gamma_4 X_3 + \varepsilon_2 \quad (2)$$

In the context of descriptive associations, the Pearson product–moment correlation between any two continuous variables, X and Y, is defined as.

$$r_{XY} = \frac{\sum(X-\bar{X})(Y-\bar{Y})}{\sqrt{\sum(X-\bar{X})^2 \sum(Y-\bar{Y})^2}} \quad (3)$$

3.9. SWOT Analysis

In order to maintain the emphasis on measurement and analysis, the SWOT perspective is not presented as a matrix in this instance. Instead, the synthesis of triangulated evidence (survey patterns, interview themes, and documentation) in the Discussion connects empirical findings with policy design.

4. RESULTS

4.1. Descriptive Evidence of Digital Transformation

The transition from paper-based to platform-based workflows has had a significant impact on the manner in which decisions are prepared and validated. In comparison with the pre-digital baseline, contemporary agencies now utilize integrated systems for the execution of submission, tracking, verification, and archiving. The descriptive patterns indicate that cycle times are reduced, manual handover procedures are minimized, and audit trails are more clearly defined. The empirical regularities that have been identified are the motivation for the causal tests that are reported in Section 4.5. In this section, the question of whether digitalization improves decision quality is examined, and whether this, in turn, improves decision efficiency and effectiveness.

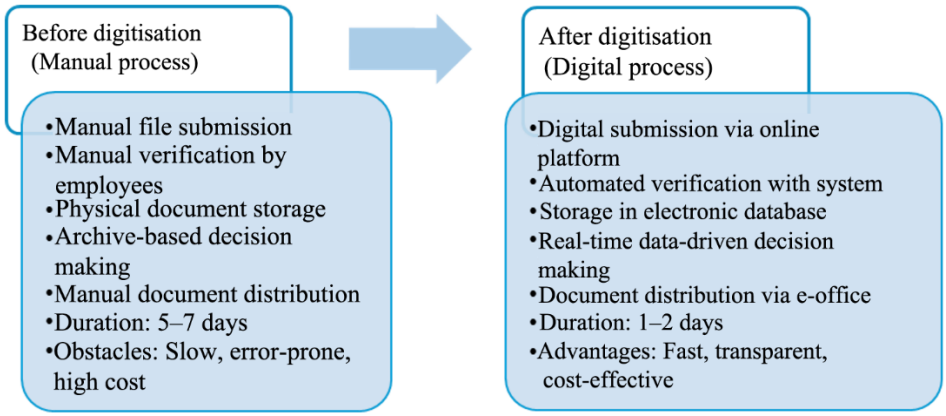

Figure 2. Digital transformation in public services.

Figure 2 presents the digital transformation of public services by contrasting the pre-digitisation manual workflow with the post-digitisation digital workflow. It shows that, before digitisation, files are submitted in person, verification is performed manually, records are kept in physical archives, decisions rely on archived documents, and distribution is manual, resulting in slow, error-prone, and costly processing that takes five to seven days. After digitisation, submissions occur via an online platform, verification is automated, records are stored in electronic databases, decision-making is real-time and data-driven, and documents are distributed through the e-office; consequently, processing is completed in one to two days and becomes faster, more transparent, and cost-effective. This comparison underscores the mechanism by which digitisation enhances decision quality and efficiency in Makassar City.

4.2. Information Transparency

Survey responses indicate that access to timely and auditable information has improved following the implementation of digitalisation. The majority of respondents reported an enhancement in the transparency of information flows, with open dashboards and traceable decision trails frequently cited as reasons. This pattern is theoretically consistent with the proposition that transparency enhances the evidentiary basis of decisions. In Section 4.5, we proceed to test H2 and demonstrate that transparency exerts a positive and statistically significant association with decision-making quality, subsequent to controlling for extraneous factors.

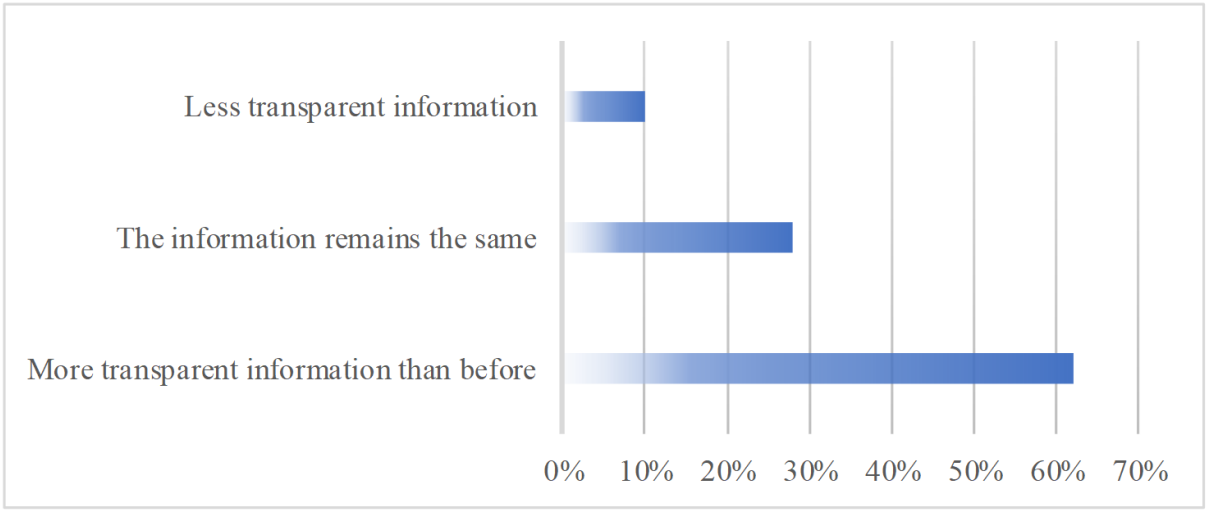

Figure 3. Level of information transparency in the digitalisation of public services.

Figure 3 presents respondents' perceptions of information transparency in Makassar City following the digitalisation of public services. It shows that approximately 62% of respondents perceive more transparent information than before, about 28% state that transparency remains the same, and around 10% report less transparency. This pattern indicates a significant improvement in the openness of information within Makassar City's public administration. The results suggest that digitalisation facilitates better access to data and clearer communication channels between the government and citizens. Such improvement reinforces the notion that digitalisation enhances evidence-based decision-making by increasing information visibility and institutional accountability across the governance system of Makassar City.

4.3. Employee Participation

Digital reforms also coincided with stronger employee engagement, as evidenced by respondents' frequent reports of participation in digital skills training, provision of feedback on system features, and involvement in cross-unit process improvements. These findings lend support to the behavioural mechanism whereby participation fosters ownership and improves system use. Section 4.5 provides confirmation of H3, which states that participation is positively and significantly associated with decision-making quality when modelled alongside digitalisation and transparency.

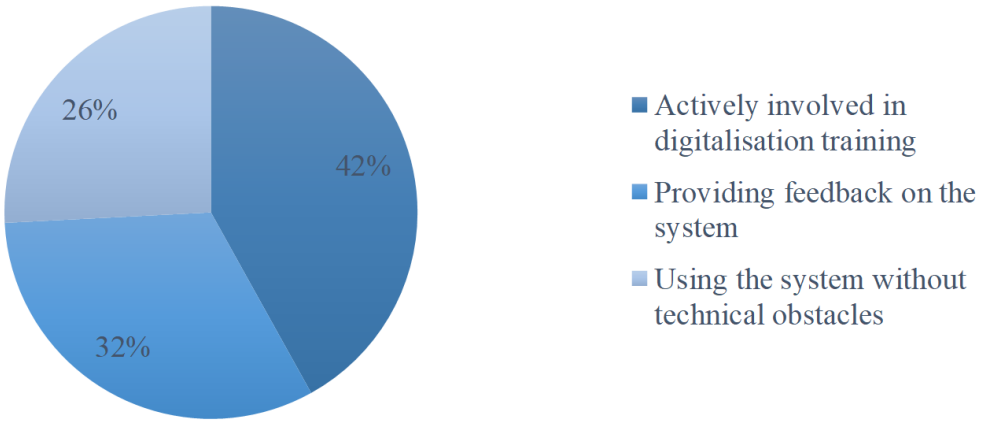

Figure 4. Employee participation in the digitalisation of public services.

Figure 4 presents employee participation in the digitalisation of public services in Makassar City. It shows that 42% of employees are actively involved in digitalisation training, 32% provide feedback on the system, and 26% use the system without technical obstacles. This distribution indicates that most civil servants in Makassar City public administration are constructively engaged in supporting digital transformation. The high proportion of training participation reflects the government's effort to strengthen employees' digital competence, while continuous feedback suggests a responsive and collaborative work culture. Meanwhile, the ability of some employees to operate the system smoothly demonstrates improved infrastructure and technical readiness. These results demonstrate that active employee involvement plays a crucial role in sustaining the implementation and effectiveness of digital governance initiatives in Makassar City.

4.4. Decision-Making Efficiency

Administrative efficiency was found to have improved substantially following the implementation of digitalisation. The mean turnaround time for routine decisions decreased over time, in line with the adoption of automated verification and electronic routing. The respondents attributed the enhanced decision-making processes to real-time access to data, reduced duplication, and improved inter-agency coordination. These descriptive

improvements anticipate the structural result in Section 4.5, which indicates that higher decision quality is associated with greater efficiency and effectiveness.

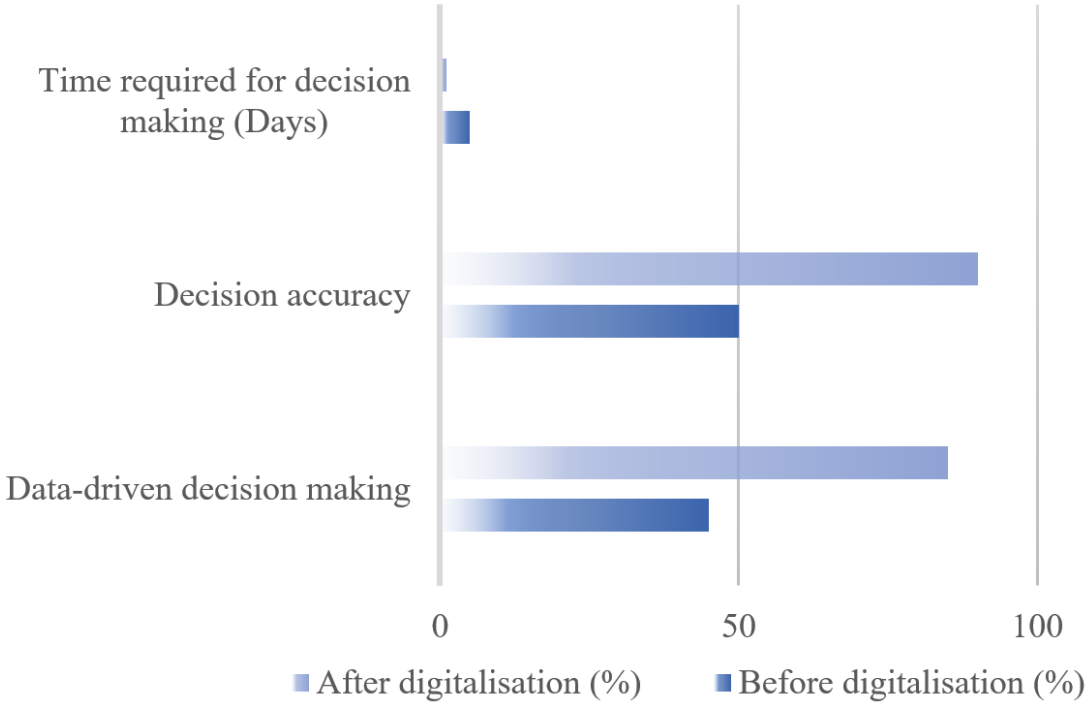

Figure 5. Comparison of document processing times before and after digitisation.

Figure 5 presents the comparison of decision-making indicators before and after the digitalisation of public services in Makassar City. The results indicate a substantial improvement across all aspects. The time required for decision-making decreases sharply from an average of five to seven days before digitalisation to only one to two days after. Decision accuracy rises significantly from around 50% before to nearly 90% after digitalisation, while data-driven decision-making increases from approximately 45% to 85%. These changes illustrate how digitalisation enhances both the efficiency and quality of administrative processes. Shorter decision times reflect smoother workflows and reduced bureaucratic delays, while the higher level of accuracy and reliance on data demonstrate improved analytical capacity and information management. The evidence clearly shows that the implementation of digital systems in Makassar City has strengthened evidence-based governance and improved the overall performance of public decision-making.

4.5. Path Analysis: The Impact of Digitalisation on Decision-Making Efficiency

A path model was estimated in which digitalisation (X1), information transparency (X2), and employee participation (X3) were predicted to influence decision quality (Y), which in turn was predicted to influence decision efficiency and effectiveness (Z). The model demonstrates that digitalisation exerts a significant positive influence on the quality of decision-making processes ($\beta = 0.68$, $p < 0.01$). The analysis indicates that enhanced information transparency ($\beta = 0.55$, $p < 0.05$) and employee participation ($\beta = 0.62$, $p < 0.05$) are positively associated with the outcomes under scrutiny. The quality of the decision-making process has been shown to be a significant predictor of efficiency and effectiveness in decision-making, with a substantial coefficient. The overall model demonstrates a substantial degree of explanatory power, with an R^2 value of approximately 0.864. Of particular note is the finding that digitalisation exerts a substantial indirect effect on efficiency and effectiveness through decision-making quality ($\beta = 0.72$, $p < 0.01$), a finding that is consistent with the mediation hypothesis. Collectively, these results establish a cohesive causal narrative, whereby transparency and participation serve as conduits through which digitalisation

enhances the quality of decision-making processes. Consequently, decisions of higher quality are executed with greater efficiency and efficacy.

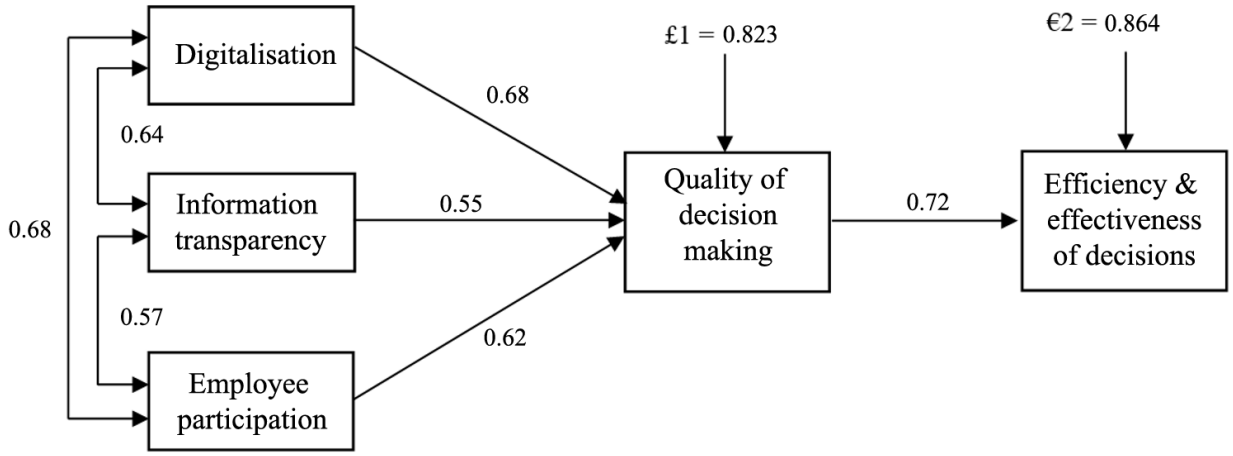

Figure 6. The relationship between digitalisation, information transparency, and employee participation and the efficiency of decision-making in public services.

Figure 6 presents the structural relationship among digitalisation, information transparency, and employee participation in improving the efficiency and effectiveness of decision-making in Makassar City public services. The results show that digitalisation exerts the strongest direct influence on decision-making quality ($\beta = 0.68$, $p < 0.01$), confirming that the implementation of digital governance enhances the speed, accuracy, and consistency of administrative processes. Information transparency ($\beta = 0.55$, $p < 0.05$) also has a significant positive effect, demonstrating that open and easily accessible information increases accountability and supports evidence-based decision-making.

Likewise, employee participation ($\beta = 0.62$, $p < 0.05$) contributes meaningfully by encouraging collaboration, innovation, and shared responsibility in digitalised service delivery. Furthermore, decision-making quality exerts a strong effect on decision efficiency and effectiveness ($\beta = 0.72$, $p < 0.01$), and the model explains 86.4% of the variance in decision outcomes ($R^2 = 0.864$).

These findings confirm that digitalisation enhances decision quality both directly and indirectly through transparency and participation. The empirical evidence demonstrates that digital governance in Makassar City integrates technology, openness, and human participation as key enablers for improving efficiency, effectiveness, and transparency in public service performance, thereby strengthening the sustainability of digital transformation in governance.

4.6. SWOT Analysis in the Digitalisation of Public Services

In order to translate the statistical findings into actionable guidance, a synthesis was performed of the strengths (faster cycle times, greater transparency), weaknesses (skills gaps, uneven adoption), opportunities (integration and analytics), and threats (cybersecurity, regulatory fragmentation). The aforementioned themes provide the foundation for the policy recommendations outlined in the discussion, where we place a premium on the development of digital skills, the enhancement of infrastructure reliability, the establishment of data governance standards, and the implementation of security protocols. These measures are intended to ensure the sustained enhancement of efficiency gains that have been observed.

Table 1. SWOT matrix for public service digitalisation strategy.

Internal External	**Strengths (S)**	**Weaknesses (W)**
	1. Accelerate decision-making and service efficiency. 2. Increase transparency and accountability. 3. Reduce administrative burden and operational costs. 4. Enable real-time access to data and documents.	1. Digital literacy gap among employees. 2. Uneven implementation in various regions. 3. High dependence on internet infrastructure. 4. Employee resistance to technological change.
Opportunities (O)	Strategy (SO)	Strategy (WO)
1. Rapid development of digital technology (AI, Big Data, Blockchain). 2. Government policy supports accelerating e-Government and smart cities. 3. Increased community participation in the use of digital services.	1. Develop cloud-based digital infrastructure to increase data integration efficiency. 2. Integrate artificial intelligence in data processing for evidence-based decision making. 3. Implement a single-data-based public service system to increase inter-agency interoperability.	1. Provide digital literacy training for civil servants and the community to increase readiness for technology adoption. 2. Increase investment in strengthening internet networks and technology infrastructure in remote areas. 3. Develop a digital adoption policy that is oriented towards gradual change so that employees can adapt more easily.
Threats (T)	Strategy (ST)	Strategy (WT)
1. Risk of cyber attacks and data leaks. 2. Digital divide between regions. 3. Organisational culture resistance to technological change.	1. Strengthen cybersecurity measures and implement international data protection standards (ISO 27001, GDPR). 2. Increase investment in digital infrastructure in remote areas to ensure equitable access. 3. Build an innovation-based work culture by providing incentives for employees who actively use digital systems.	1. Develop stricter data protection regulations to address the risk of information leakage. 2. Adopt a hybrid (manual and digital) approach in the transition period for a more inclusive implementation. 3. Develop communication and socialization programs to increase employee acceptance of digital systems.

Table 1 presents a SWOT matrix that identifies the internal and external factors influencing the digitalisation of public services in Makassar City. The strengths emphasize faster decision-making and service efficiency, improved transparency and accountability, reduced administrative burdens and operational costs, and real-time access to data. The weaknesses highlight gaps in employees' digital literacy, uneven implementation across regions, dependence on internet infrastructure, and resistance to technological change. Externally, opportunities arise from rapid advancements in digital technology such as AI, Big Data, and Blockchain, strong policy support for e-Government and smart city initiatives, and growing community participation in digital services. Meanwhile, threats include the risk of cyberattacks and data leaks, regional digital divides, and organizational culture resistance that limits innovation.

Based on this assessment, the table elaborates four interrelated strategic approaches. The SO strategies aim to maximise strengths and seize opportunities by developing cloud-based infrastructure to improve data integration, integrating artificial intelligence into data processing for evidence-based decision-making, and implementing a single-data-based system to strengthen inter-agency interoperability. The WO strategies focus on overcoming weaknesses by leveraging opportunities through digital literacy training, infrastructure investment, and a gradual adoption policy to facilitate employee adaptation. The ST strategies use internal strengths to counter threats via stronger cybersecurity frameworks, equitable infrastructure development, and an innovation-oriented work culture supported by incentives. Lastly, the WT strategies mitigate both weaknesses and threats by enforcing data protection regulations, adopting a hybrid manual–digital transition, and enhancing communication and socialisation

programmes. Collectively, these strategies integrate technology, human capacity, and governance reform to achieve efficient, effective, and transparent public service delivery in Makassar City.

5. DISCUSSION

5.1. Mechanisms: From Digitalisation to Better Decisions

The results indicate that digitalisation is strongly and positively associated with decision-making quality (β paths reported in Results). Moving core workflows submission, verification, routing, and archiving onto integrated platforms reduces frictions that previously delayed or distorted information. This is consistent with evidence that digital government initiatives reshape administrative work and enable data-driven choices (Andersson et al., 2022; Kuziemski & Misuraca, 2020; Lindgren & Van Veenstra, 2018; Milakovich, 2021; Newman et al., 2022). In our setting, real-time access to auditable data improves the timeliness and accuracy of decisions, aligning with the observed decline in mean processing time after adoption.

5.2. The Roles of Transparency and Participation

Two organisational levers clarify how digitalisation improves decisions. First, information transparency increased after platform adoption as staff reported easier access to up-to-date datasets and traceable decision trails. Prior studies show that openness strengthens accountability, reduces information asymmetry, and stabilises decision criteria effects documented in routine service delivery and in crisis governance (Abdou, 2021; Agustino et al., 2022; Androniceanu, 2021; Kovač et al., 2021; Latupeirissa et al., 2024; Lee-Geiller & Lee, 2022; Pekkarinen et al., 2021). Transparency gains also interact with institutional reforms such as open-data and anti-corruption programmes (Alam, Aftab, Abbas, Ugli, & Bokhari, 2023; Arayankalam, Khan, & Krishnan, 2021; Troitiño, Mazur, & Kerikmäe, 2024). Second, employee participation training, continuous feedback, and cross-unit collaboration increased alongside digital reforms; participation is a significant predictor of decision quality in our model, in line with work that links civil-service capability and participatory governance to effective digital transformation (Maxwell et al., 2019; Qvarfordt & Lagrosen, 2024; Rojikinnor, 2020; Salam, 2021; Sary et al., 2024; Yuniarti et al., 2024). Resistance rooted in job-security fears and misaligned routines can, however, dampen these benefits (Plesner & Justesen, 2021; Yoon, 2019) underscoring the role of change-management and skills development (Cetindamar Kozanoglu & Abedin, 2021; Coco, Colapinto, & Finotto, 2024; Reddy, Chaudhary, & Hussein, 2023).

5.3. From Decision Quality to Administrative Efficiency

Higher-quality decisions translate into greater efficiency and reliability in execution, a relationship captured by the positive path from decision quality to efficiency and effectiveness in the model. The narrative evidence is consistent: once information is timely and auditable, and frontline staff are engaged, coordination improves, rework decreases, and cases progress with fewer handoffs. These patterns match broader findings on time and cost savings from e-government and platform adoption (Bosio, Hayman, & Dubosse, 2023; Matitah et al., 2021; Vimala, Vasantha, & Shanmathi, 2023; Vrabie, 2023) as well as sectoral accounts of accelerated processing through automation and integration (Kulal et al., 2024; Saruji & Hamid, 2021; Utama, 2020).

5.4. Policy and Management Implications for Makassar City

Four priorities emerge. Capability: institutionalize continuous digital-skills programmes so new features are adopted promptly and used properly (Bilan et al., 2023; Maxwell et al., 2019). Infrastructure: ensure platform uptime, secure connectivity, and interoperability to keep data accessible across agencies (Aristovnik et al., 2024; Di Giulio & Vecchi, 2021). Rules: Harmonize regulations and internal procedures to avoid duplication and to standardize evidence requirements for similar decisions (Putrevu & Mertzanis, 2024; Schou & Pors, 2019). Security and governance: embed cybersecurity and data-governance protocols, access control, logging, incident response so transparency does not

compromise privacy (Frandell & Feeney, 2022; Gale, Bongiovanni, & Slapnicar, 2022; Karampela, Ouhbi, & Isomursu, 2019; Slapničar, Axelsen, Bongiovanni, & Stockdale, 2023). Given uneven adoption across units (Norling, 2025; Wawo & Majid, 2021), targeted support for lagging offices and inclusive service design are essential to prevent a widening divide.

5.5. Limitations and Future Research

The evidence comes from one metropolitan administration and relies primarily on self-reports and managerial perceptions, which may introduce common-method and social-desirability biases despite safeguards. Future research should combine surveys with behavioral usage logs and administrative microdata to track how tasks evolve. Comparative designs across cities or tiers of government would test external validity, while longitudinal approaches could identify dynamic learning effects and the durability of gains (Atobishi, Moh'd Abu Bakir, & Nosratabadi, 2024; Breit et al., 2021; Norling, 2025; Schou & Pors, 2019). Heterogeneity analyses by agency type and decision category could reveal where digitalization yields the largest returns and where complementary investments are most needed (Aristovnik et al., 2024; Dunleavy & Margetts, 2023; Govers & Van Amelsvoort, 2023).

6. CONCLUSION

This study demonstrates that digitalisation improves decision-making in Makassar's public administration by strengthening decision quality and, through it, raising decision efficiency and effectiveness. In the structural model, digitalisation, information transparency, and employee participation are each positively associated with decision-making quality; the model explains a substantial share of the variance in efficiency outcomes, and average decision-processing time declined markedly after adoption.

Together, these results indicate that technology, data openness, and engagement are complementary drivers of better, faster public decisions. Policy priorities follow directly. To sustain and scale gains, the city should institutionalise continuous digital-skills development for civil servants, ensure reliable and interoperable infrastructure, harmonise procedures and regulations to reduce duplication, and embed cybersecurity and data-governance safeguards.

Inclusive service design and targeted support for lagging units are essential to avoid deepening digital divides. Limitations include the single-city scope and reliance on self-reports; future research should combine survey evidence with usage logs and administrative microdata, and employ comparative and longitudinal designs to assess external validity and durability of effects.

7. POLICY SUGGESTION

7.1. Rationale and Link to Findings

The empirical model demonstrates that digitalisation, information transparency, and employee participation each enhance decision-making quality. Higher-quality decisions subsequently improve decision efficiency and effectiveness. Therefore, policy should aim to strengthen these levers simultaneously. The following implications translate the evidence into a practical roadmap for Makassar's administration.

7.2. Capability and Change Management

Institutionalize a role-based digital-skills programme for the State Civil Apparatus (ASN). Move from ad-hoc workshops to tiered learning (foundation, intermediate, advanced) aligned with job families (frontline, analysts, supervisors). Pair training with change-management tools, peer champions, recognition for evidence-based practices, and manager check-ins to convert system adoption into routine use. Establish quarterly feedback loops so that users' needs inform feature upgrades.

7.3. Infrastructure Reliability and Interoperability

Efficiency gains depend on reliable, interoperable platforms. Prioritize high system uptime, secure connectivity, and seamless links among core registries, case-management, and document repositories. Implement an integration layer (standard APIs and a common data dictionary) so data follow the case across agencies without re-entry. Maintain business-continuity plans that cover power, network, and application failure to prevent service delays.

7.4. Data Governance, Privacy, and Cybersecurity

As transparency expands, safeguards must keep pace. Institute role-based access control, audit logging, and incident response procedures, and schedule periodic security testing. Adopt proportionate data protection rules (classification, minimization, retention schedules) and publish a plain-language privacy notice. A cross-agency data governance committee should set standards for data quality, metadata, sharing protocols, and open data release where appropriate.

7.5. Inclusive and Accessible Digital Services

To avoid widening digital divides, design for inclusion from the outset. Provide multilingual interfaces and disability-friendly features, maintain assisted-digital counters for complex cases, and carry out mobile outreach to underserved areas. Track differential outcomes (e.g., urban/rural, age, disability) and target support to lagging units. Regular co-design sessions and user panels ensure improvements reflect citizen priorities.

7.6. Regulatory Harmonisation and Process Standardisation

Reduce duplication by harmonising regulations and standardising evidence requirements for similar decisions. Replace blanket approvals with risk-based checkpoints and publish standard operating procedures that map process steps to data fields in the platform. Formal memoranda should codify inter-agency responsibilities, service-level targets, and escalation paths, reducing handoffs and rework.

7.7. Monitoring, Evaluation, and Learning

Institutionalize performance monitoring that mirrors the outcomes in this study. Track decision cycle time, rework/error rates, data completeness/auditability, training coverage, and system uptime/interoperability incidents. Review dashboards every quarter, diagnose bottlenecks, and assign corrective actions. Use short learning sprints to test process tweaks and scale what works.

7.8. Implementation Timeline and Ownership

Within 6–12 months, prioritize: (i) launching the role-based training curriculum and peer-champion network; (ii) deploying the integration layer and common data dictionary for high-volume transactions; (iii) approving a city-wide data-governance policy with security and privacy controls; (iv) rolling out inclusive access measures (assisted-digital desks and usability fixes); and (v) establishing a results-oriented review routine centered on cycle time, data completeness, and rework. Assign clear ownership: the CIO office steers architecture and security; HRD leads capability building; each agency designates a process owner accountable for targets.

7.9. Expected Benefits and Risks

If implemented coherently, these measures reinforce the causal chain identified in the Results: transparency and participation enhance decision quality, and technology ensures that higher-quality decisions are executed faster and more reliably. The main risks are uneven adoption, cyber incidents, and policy fragmentation. The roadmap mitigates these via targeted support for lagging units, proportionate security controls, and clear governance of rules and responsibilities.

Funding: This work was supported by the Bosowa Foundation (Grant Number. 15/LPPM/I/2024). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.
Institutional Review Board Statement: This study was approved by the Institutional Review Board of the Institute for Research and Community Service (LPPM), University of Bosowa Makassar, Indonesia under protocol number (IRB No. 15/LPPM/I/2024), dated (10 January 2024). Informed verbal consent was obtained from all participants, and all data were anonymised to protect participant confidentiality; procedures complied with applicable ethical guidelines.
Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Data Availability Statement: The corresponding author can provide the supporting data of this study upon a reasonable request.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Disclosure of AI Use: The author used OpenAI's ChatGPT (GPT-4) to edit and refine the wording of the Introduction and Literature Review. All outputs were thoroughly reviewed and verified by the author.

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